

Applicant: Xuzhi Qin  
 Serial No.: 10/694,111  
 Group Art Unit: 1626

**PATENT**  
 Docket No.: 10-9436

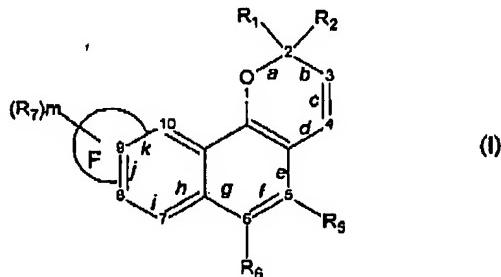
**AMENDMENTS TO THE CLAIMS**

Please amend claims 1, 14, and 15 as set forth below.

**Listing of Claims**

What is claimed is:

1. (Currently Amended) A naphthopyran compound of the following formula:



wherein

(a) F is a 5- to 7-member saturated heterocyclic ring group fused to *l* or *j* side of the naphthopyran ring and containing an oxygen atom directly connected to 7-, 8-, or 9-position;

- (b) R<sub>6</sub> represents  
 a hydrogen,  
 a C1 – C6 alkyl, alkoxy,  
 a -C(O)R group, wherein R is selected from hydrogen, hydroxy, alkyl, alkoxy,

an aryl or heteroaryl group which comprises in its basic structure (that is, in its ring atoms, the rings comprising 5, 6 or 7 atoms) 6 to 24 carbon atoms or 4 to 24 carbon atoms respectively and at least one heteroatom selected from sulfur, oxygen and nitrogen; the basic structure being optionally substituted with at least one substituent selected from:

- a halogen atom (e.g., fluorine, chlorine and bromine),
- a hydroxy group,
- a linear or branched alkyl group comprising 1 to 12 carbon atoms,
- a linear or branched alkoxy group comprising 1 to 12 carbon atoms,

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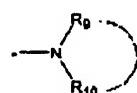
a haloalkyl or haloalkoxy group corresponding to the (C1 -C12) alkyl or alkoxy groups above respectively which are substituted with at least one halogen atom, and notably a fluoroalkyl group of this type,

a linear or branched alkenyl group comprising 2 to 12 carbon atoms, and notably a vinyl group or an allyl group,

an -NH<sub>2</sub> group,

an -NHR<sub>8</sub> group, R<sub>8</sub> representing a linear or branched alkyl group comprising 1 to 6 carbon atoms,

a



group, in which R<sub>9</sub> and R<sub>10</sub>, which are the same or different, independently representing a linear or branched alkyl group comprising 1 to 6 carbon atoms, or representing (together with the nitrogen atom to which they are bound) a 5- to 7-membered ring which can comprise at least one other heteroatom selected from oxygen, sulfur and nitrogen, said nitrogen being optionally substituted with a group that is a linear or branched alkyl group comprising 1 to 6 carbon atoms,

a methacryloyl group or an acryloyl group,

a polyether, polyamide, polycarbonate, polycarbamate, polyurea or polyester residue;

(c) R<sub>5</sub> represents:

a hydroxy,

a halogen, and notably fluorine, chlorine or bromine,

a linear or branched alkyl group which comprises 1 to 12 carbon atoms (advantageously 1 to 6 carbon atoms),

a cycloalkyl group comprising 3 to 12 carbon atoms,

a linear or branched alkoxy group comprising 1 to 12 carbon atoms (most advantageously 1 to 6 carbon atoms),

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a haloalkyl, halocycloalkyl, or haloalkoxy group corresponding to the alkyl, cycloalkyl, alkoxy groups above respectively, which are substituted with at least one halogen atom, notably selected from fluorine, chlorine and bromine,

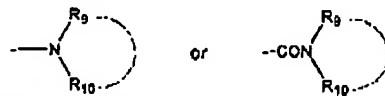
a linear or branched alkenyl or alkynyl group comprising 1-12 carbon atoms, preferably a vinyl or allyl group,

a linear or branched alkenyloxy or alkynyloxy group comprising 1-12 carbon atoms, preferably an allyloxy group,

an aryl or heteroaryl group having the same definition as R<sub>6</sub> given supra,

an aralkyl or heteroaralkyl group, the alkyl group, which is linear or branched, comprising 1 to 4 carbon atoms, and the aryl and heteroaryl groups having the same definitions as R<sub>6</sub> given supra,

an amine or amide group: --NH<sub>2</sub>, --NHR<sub>8</sub>, --CONH<sub>2</sub>, --CONHR<sub>8</sub>,



R<sub>8</sub>, R<sub>9</sub>, and R<sub>10</sub> having their respective definitions given above for the amine substituents of the values R<sub>6</sub>,

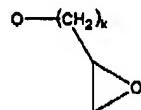
a --C(R<sub>11</sub>)<sub>2</sub>X group, wherein X is --CN, halogen, hydroxy, alkoxy, benzyloxy, C1-C6 acyloxy, amino, C1-C6 mono-alklamino, C1-C6 dialkyl amino, morpholino, piperidino, 1-indolinyl, pyrrolidyl, or trimethylsilyloxy, R<sub>11</sub> is hydrogen, C1-C6 alkyl, phenyl or naphthyl with C1-C6 alkyl or C1-C6 alkoxy substituents,

an --OCOR<sub>12</sub> or --COOR<sub>12</sub> group, R<sub>12</sub> representing a straight or branched alkyl group comprising 1 to 6 carbon atoms, or a cycloalkyl group comprising 3 to 7 carbon atoms, or a phenyl group, optionally substituted with at least one of the substituents listed above within the values in the definitions of R<sub>6</sub>,

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a methacryloyl group or an acryloyl group, an epoxy group having the formula,



in which k = 1, 2 or 3,

a polyether, polyamide, polycarbonate, polycarbamate, polyurea or polyester residue;

- (d) R<sub>1</sub> and R<sub>2</sub>, which are identical or different, independently represent:
  - a hydrogen,
  - a linear or branched alkyl group which comprises 1 to 12 carbon atoms (with or without substitution),
  - a cycloalkyl group which comprises 3 to 12 carbon atoms,
  - an aryl or heteroaryl group as R<sub>6</sub> defined supra,
  - an aralkyl or heteroaralkyl group, the alkyl group, which is linear or branched, comprising 1 to 4 carbon atoms and the aryl and heteroaryl groups having the definitions given above, or
  - the two substituents R<sub>1</sub> and R<sub>2</sub> together forming ring group such as those represented by an adamantyl, norbornyl, fluorenylidene, 5,5- or 10,10-di(C<sub>1</sub> -C<sub>6</sub>)alkylanthracenylidene, 5 (or 10)-(C<sub>1</sub>-C<sub>6</sub>)alkyl-5 (or 10)-OH (or OR<sub>15</sub>)anthracenylidene or spiro(C<sub>5</sub> -C<sub>6</sub>)cycloalkylanthracenylidene ring group; said ring group being optionally substituted with at least one of the substituents listed above in the definitions for R<sub>1</sub>, R<sub>2</sub>; said ring group being optionally substituted with two adjacent groups that form a 5- to 6-member aromatic or non-aromatic ring which can comprise at least one heteroatom selected from oxygen, sulfur, and nitrogen;

- (e) each R<sub>7</sub> group can be the same or different, independently representing
  - a hydrogen,
  - a linear, branched, or cyclic alkyl group,
  - a linear, branched, or cyclic alkoxy group,

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a linear or branched alkenyl or alkynyl group,  
a linear or branched alkenyloxy or alkynyloxy group,  
an aryl or heteroaryl group having the same definition as that given  
supra for R<sub>6</sub>,

two of the R<sub>7</sub> groups, which are adjacent or bonded to the same  
carbon atom in the group F, form a 5- to 7-membered non-aromatic ring which  
may comprise at least one heteroatom selected from the group consisting of  
oxygen, sulfur, and nitrogen, and

m is an integer of 0 to 6.

2. (Original) The naphthopyran compound according to claim 1, wherein:

m and n are integers of 1 or 2,

R'<sub>1</sub> and R'<sub>2</sub>, same or different, represent

a hydrogen,

a linear, branched, or cyclic alkyl,

an alkoxy with the alkyl portion being linear, branched, or cyclic,

an unsubstituted, mono- or di-substituted aromatic group,

an aryloxy with the aryl being unsubstituted, mono- or di-  
substituted;

R<sub>5</sub> represents

a linear, branched, or cyclic alkyl group,

a linear or branched alkenyl or alkynyl group,

a -C(R<sub>11</sub>)<sub>2</sub>X group, wherein X is hydroxy, alkoxy, benzyloxy, C1-  
C6 acyloxy,

an optionally substituted phenyl or benzyl group,

a -COR<sub>12</sub>, or -COOR<sub>12</sub> group, R<sub>12</sub> representing a linear, branched,  
or cyclic alkyl group comprising 1 to 6 carbon atoms;

R<sub>6</sub> represents a unsubstituted, mono- or di-substituted aromatic or hetero-  
aromatic group selected from phenyl, naphthyl, pyridyl, furanyl, benzofuranyl,  
thenyl, benzothienyl;

R<sub>7</sub> represents

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a hydrogen,  
a linear, branched, or cyclic alkyl group,  
a linear, branched, or cyclic alkoxy group,  
a linear or branched alkenyl or alkynyl group,  
a linear or branched alkenyloxy or alkynyloxy group,  
an aryl or heteroaryl group having the same definition as that given supra for R<sub>6</sub>,

two of the R<sub>7</sub> groups, which are adjacent or bonded to the same carbon atom in the group F, form a 5- to 7-membered non-aromatic ring which may comprise at least one hetroatom selected from the group consisting of oxygen, sulfur, and nitrogen, and

m is an integer of 0 to 2.

3. (Original) The naphthopyran compound according to claim 1, being further crosslinked.

4. (Original) The naphthopyran compound according to claim 1, being further polymerized.

5. (Original) A photochromic composition comprising:

at least one compound according to claim 1;

at least one linear or cross-linked (co)polymer which contains, in its structure, at least one compound according to claim 1;

at least one additional photochromic compound of another type;

at least one non-photochromic coloring agent; and

at least one stabilizing agent.

6. (Original) The naphthopyran compound according to claim 1 being further incorporated into a (co)polymer matrix.

7. (Original) The naphthopyran compound according to claim 5 being further incorporated into a (co)polymer matrix.

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8. (Original) A (co)polymer matrix comprising at least one co(polymer) and/or reticulate according to claim 4.

9. (Original) A (co)polymer matrix according to claim 6 further comprising one or more (co)polymer selected from the group consisting of: an alkyl, cycloalkyl, (poly or oligo)ethylene glycol or aryl or arylalkyl mono-, di-, tri-, or tetraacrylate or mono-, di-, tri-, or tetramethacrylate which is optionally halogenated or which optionally comprises at least one ether and/or ester and/or carbonate and/or carbamate and/or thiocarbamate and/or urea and/or amide group; polystyrene, polyether, polyester, polycarbonate, polycarbamate, polyepoxy, polyurea, polyurethane, polythiourethane, polysiloxane, polyacrylonitrile, polyamide, aliphatic or aromatic polyester, vinylic polymers, cellulose acetate, cellulose triacetate, cellulose acetate-propionate, polyvinylbutyral, poly(methyl methacrylate), poly(ethylene glycol bismethacrylate), poly(ethoxylated bisphenol A dimethacrylate), poly(vinyl acetate), polyvinylbutyral, polyurethane, polyanhydride and polymers of members of the group consisting of diethylene glycol bis(allyl carbonate) monomers, diethylene glycol dimethacrylate monomers, ethoxylated phenol bismethacrylate monomers, diisopropenyl benzene monomers and ethoxylated trimethylol propane triacrylate monomers.

10. (Original) The naphthopyran compound according to claim 1 being further incorporated into an ophthalmic lens.

11. (Original) The naphthopyran compound according to claim 5 being further incorporated into an ophthalmic lens.

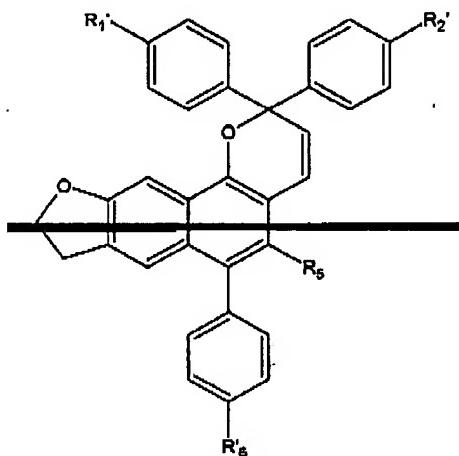
12. (Original) The naphthopyran compound according to claim 3 being further incorporated into an ophthalmic lens.

13. (Original) The naphthopyran compound according to claim 6 being further incorporated into an ophthalmic lens.

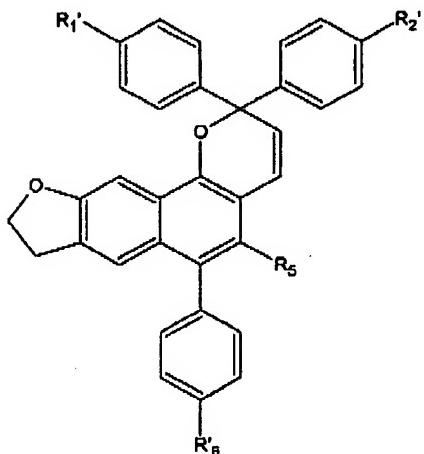
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14. (Currently Amended) The naphthopyran compound according to claim 9 being further incorporated into an ophthalmic lens.



15. (Currently Amended) A naphthopyran compound of the following formula:



in which,

R'<sub>1</sub>, R'<sub>2</sub>, and R'<sub>6</sub>, same or different, represent

a linear, branched, or cyclic alkyl group,

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an alkoxy group with the alkyl portion being linear, branched, or cyclic;

R<sub>5</sub> represents

a linear, branched, or cyclic alkyl group,

a linear or branched alkenyl or alkynyl group,

a -C(R<sub>11</sub>)<sub>2</sub>X group, wherein X is hydroxy, alkoxy, benzyloxy, C1-C6 acyloxy, R<sub>11</sub> is hydrogen or C1-C6 alkyl;

an substituted phenyl or benzyl group,

a -COR<sub>12</sub>, or --COOR<sub>12</sub> group, R<sub>12</sub> representing a linear, branched, or cyclic alkyl group comprising 1 to 6 carbon atoms, or an substituted phenyl or benzyl group.